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FLUORESCENT DISCHARGE LAMP

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FLUORESCENT DISCHARGE LAMP

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1. Title of Invention

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Fluorescent discharge lamp.

2. Scope of Patent Claim

A fluorescent discharge lamp composed of a linear glass tube, electrodes sealed at both ends, mercury and rare gas sealed in the aforementioned glass tube, fluorescent substance clad on the inner walls of the aforementioned glass tube and a clad conducting strip extending virtually the entire length of the aforementioned glass tube in the axial direction on the inner surface of said tube. The entire length is approximately 1,200 mm, the outer diameter of the tube is 31 to 34 mm and the aforementioned sealed rare gas is argon or is composed primarily of argon at a pressure of 2.7 to 3.3 Torr.

3. Detailed Description of the Invention

This invention relates to a fluorescent lamp, specifically to a fluorescent, low pressure hydrogen vapor discharge lamp, particularly to a rapid (starting) fluorescent lamp, and most specifically to a lamp with a conducting strip clad in the axial direction of the glass tube on the inner walls.

A ballast with high circuit voltage is used without employing glow lamps in uses in which rapid starting is desired, and the lamp is illuminated when the power switch is thrown. In this case as well, the aforementioned circuit voltage should be as low as possible for safety and other reasons. For that reason, cathodes capable of being heated constantly along with various auxiliary means of starting are generally employed in rapidly illuminating fluorescent lamps. Specifically, typical

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methods include installation of a transparent conducting film on the entire inner surface of the tube, installation of a conducting thin strip in the axial direction on the inner surface or outer surface of the tube, or connection of those to the main electrodes.

The starting voltage of a fluorescent lamp varies greatly depending on the type of the auxiliary starting method, and it is greatly affected by other constituent elements of the fluorescent lamp as well as by the ambient conditions.

The improvements in this invention center on the glass tube which has a linear shape. The total length of the lamp is approximately 1,200 mm (specifically, the distance from the tip of the shell of the base of the tube to the opposite side is $1,198 \pm 1.5$ mm), the outer diameter of the glass tube is 32.5 mm while the conducting strip is clad in the axial direction on the inner surface of the tube. This type of tube is used extensively in offices and factories at present, and it has a high industrial value. /388

However, when large quantities of these fluorescent lamps are used, they frequently do not start quickly, especially in the summer. This type of fluorescent lamp originally had an outer tube diameter of 38 mm, but recently, that has been reduced to 32.5 mm. When the tube diameter was 38 mm, starting was not impaired since the tube and the ballast were designed to be compatible, but disturbances developed as the tube diameter shrank. However, since the tube of smaller diameter was more practical because it required less room, elimination of the problems involved in starting was required. Originally, the structure of the ballasts to be combined with fluorescent lamps was altered, and the problem of starting was eliminated through the use of the aforementioned high circuit voltage, but raising

the circuit voltage of the ballast was itself undesirable, and such fluorescent lamps could not be interchanged with conventional ballasts and fixtures, which was a fatal flaw.

Consequently, the objective of this invention is to provide a rapid illuminating fluorescent lamp 1,200 mm long and 32.5 mm in diameter with an interior conducting strip which would be compatible with conventional fixtures and ballasts.

To achieve this objective, the fluorescent lamp of this invention is composed of a linear glass tube, electrodes sealed at both ends, mercury and rare gas sealed in the aforementioned glass tube, fluorescent substance clad on the inner walls of the aforementioned glass tube and a clad conducting strip extending virtually the entire length of the aforementioned glass tube in the axial direction on the inner surface of said tube. The entire length is approximately 1,200 mm, the outer diameter of the tube is 31 to 34 mm and the aforementioned sealed rare gas is argon or is composed primarily of argon at a pressure of 2.7 to 3.3 Torr.

This invention is explained below through an actual example while referring to figures.

The fluorescent discharge lamp of this invention has preheating cathodes 2, 2' at both ends of the linear glass tube 1, as illustrated in figure 1. The interior of the tube is sealed with mercury 3 and argon gas 4. A fluorescent substance 5 is clad on the inner surface of the tube. The tube length L (distance from the tip of the shell of the base of the tube to the opposite side) is 1,198 mm while the diameter of the glass tube is 32.5 mm. A conducting strip 6 of 3 mm width (resistance 200 Ω) is clad in the axial direction between the layer of fluorescent substance on the inner walls of the tube and the

glass walls, and the layer of fluorescent substance at the tip of the strip is removed. The pressure of the aforementioned argon is 3.0 Torr.

As a result, starting using conventional ballasts is certain in a temperature range from -10°C to 50°C . The gas pressure ranges from 2.7 Torr to 3.3 Torr, and the objective is achieved.

Figure 2 illustrates changes in the starting voltage in relation to the ambient temperature when the gas pressure in the aforementioned tube is altered. In the figure, the ordinate represents the percentage ratio of the input voltage of the ballast (for 40 watt rapid fluorescent lamps as stipulated in JIS O 8108) in relation to the rated input voltage while the abscissa represents the temperature of the tube prior to starting. Curves a, b, c, d, e and f represent the changes in the input voltage required in the cases of gas pressures of 2.0, 2.4, 2.7, 3.0, 3.5 and 5.0 Torr respectively. These curves are virtually unchanged in ranges of tube outer diameter of 31 to 34 mm and in ranges of resistance by the conducting strip of $10\ \Omega$ to $2,000\ \Omega$. In conventional fluorescent lamps, low gas pressure of 2.0 Torr or 2.4 Torr was desirable since the starting voltage also fell. A view of figure 2 indicates that to be the case when the temperature of the fluorescent lamp is 20°C or 25°C under standard test conditions, but when the temperature rose to 40°C or 50°C , the starting voltage rose, reaching 115%. The starting difficulty of conventional fluorescent lamps at high temperatures is represented in this fashion. The tube would start under the rated input voltage of the ballast at a temperature range of -10°C to 50°C when the gas pressure is set at 2.7 to 3.3 Torr. A rapidly illuminating fluorescent lamp of 32.5 mm inner diameter and 1,200 mm length with a conducting strip on the inner surface which starts even at high temperatures with the conventional ballast was clearly produced here.

Curve b' in figure 2 represents the changes in the starting voltage under the same conditions as those in the aforementioned examples using a conventional fluorescent lamp, specifically one with 2.4 Torr gas pressure and 38 mm outer diameter. A comparison of this with curve b reveals no disturbance occurs when the tube diameter is 38 mm. /389

4. Simple Explanation of the Figures

Figure 1 is a partial section of the front of the fluorescent discharge lamp in one example of this invention. Figure 2 illustrates the relation between the temperatures of various types of fluorescent lamps before starting and the input voltage of the ballast.

1.. glass tube, 2,2'.. preheated cathode, 3.. mercury, 4.. argon gas, 5.. fluorescent substance, 6.. conducting strip

Figure 1*

* Figure not available.

Figure 2^{*}
1 input voltage of ballast (versus rated voltage) (%)
2 temperature of fluorescent lamp before starting (°C)

***Figure not available.**